

JP 2003-057883 A

(11)Publication number : 2003-057883 (51)Int.Cl. G03G 9/12
(43)Date of publication of application : 28.02.2003
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(54) ELECTROPHOTOGRAPHIC LIQUID DEVELOPER AND METHOD FOR FORMING IMAGE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an electrophotographic liquid developer so as to obtain stable images with high image density and high resolution in a liquid developer which uses chemical reaction such as UV curing and to provide a method for forming an image by using the developer.

SOLUTION: In the electrophotographic liquid developer containing at least a carrier liquid and a coloring agent, the carrier liquid contains a monomer in a liquid phase having a functional unsaturated group between carbon atoms or a polymer in a liquid phase of the monomer, and a photoreaction initiator. A material which does not decrease the volume resistance of the monomers or the polymer is used for the photoreaction initiator or a polymerization inhibitor included in the monomer or the polymer.

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 CLAIMS

[Claim(s)]

[Claim 1] In the electrophotography liquid development agent which contains support liquid and a coloring agent at least The monomer in which this support liquid had the functionality partial saturation radical of the carbon of the liquid phase, or the polymer and photoreaction initiator of the liquid phase is included. As this photoreaction initiator This monomer or its polymer is received in this photoreaction initiator. 3wt(s)% -- the electrophotography liquid development agent characterized by containing the photoreaction initiator which is not reduced or less [of the monomer before this monomer at the time of making it contain or the volume resistivity of the polymer makes this photoreaction initiator contain, or the volume resistivity of the polymer] to 1/4.

[Claim 2] In the electrophotography liquid development agent which contains support liquid and a coloring agent at least As polymerization inhibitor contained in this monomer or its polymer including the monomer in which this support liquid had the functionality partial saturation radical of the carbon of the liquid phase, or the polymer and photoreaction initiator of the liquid phase This monomer or its polymer is received in polymerization inhibitor. 3wt(s)% -- the electrophotography liquid development agent characterized by containing the polymerization inhibitor which is not reduced or less [of the monomer before the monomer at the time of making it contain or the volume resistivity of the polymer makes polymerization inhibitor contain, or the volume resistivity of the polymer] to 1/4.

[Claim 3] an electrophotography liquid development agent according to claim 1 -- setting -- as a photoreaction initiator -- this photoreaction initiator -- 3wt(s)% -- the electrophotography liquid development agent characterized by containing the photoreaction initiator which is not reduced or less [of the monomer before the monomer at the time of making it contain or the volume resistivity of the polymer makes this photoreaction initiator contain, or the volume resistivity of the polymer] to 1/2.

[Claim 4] an electrophotography liquid development agent according to claim 2 -- setting -- as polymerization inhibitor -- this polymerization inhibitor -- 3wt(s)% -- the electrophotography liquid development agent characterized by containing the polymerization inhibitor which is not reduced or less [of the monomer before the monomer at the time of making it contain or the volume resistivity of the polymer makes this polymerization inhibitor contain, or the volume resistivity of the polymer] to 1/2.

[Claim 5] The electrophotography liquid development agent characterized by the volume resistivity of a monomer with said partial saturation radical or its polymer being 1010 or more ohm-cm in claim 1 thru/or the electrophotography liquid development agent of four given in any 1 term.

[Claim 6] The electrophotography liquid development agent characterized by a monomer with said partial saturation radical or its polymer being polyfunctional in claim 1 thru/or the electrophotography liquid development agent of five given in any 1 term.

[Claim 7] The electrophotography liquid development agent characterized by said polyfunctional monomer or its polymer being 15% or less of rates of a volumetric shrinkage in an electrophotography liquid development agent according to claim 6.

[Claim 8] The electrophotography liquid development agent characterized by P.I.I (Primary Irritation Index skin irritation) of said polyfunctional monomer or its polymer being 1.0 or less in an electrophotography liquid development agent according to claim 6 or 7.

[Claim 9] The electrophotography liquid development agent characterized by the hue (Gardner) of said polyfunctional monomer or its polymer being two or less in claim 6 thru/or the electrophotography liquid development agent of eight given in

any 1 term.

[Claim 10]The electrophotography liquid development agent characterized by including aromatic series or aliphatic series urethane acrylate in a part of said polyfunctional monomer or its polymer [at least] in claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term.

[Claim 11]The electrophotography liquid development agent characterized by including epoxy acrylate in a part of said polyfunctional monomer or its polymer [at least] in claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term.

[Claim 12]The electrophotography liquid development agent characterized by including polyester acrylate in a part of said polyfunctional monomer or its polymer [at least] in claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term.

[Claim 13]The electrophotography liquid development agent characterized by viscosity being 100 thru/or 10000 mPa-s in claim 1 thru/or the electrophotography liquid development agent of 12 given in any 1 term.

[Claim 14]The electrophotography developer with which a coloring agent is characterized by carrying out Flushing by 30 degrees C of softening temperatures, and 120-degree C resin in claim 1 thru/or the electrophotography liquid development agent of 13 given in any 1 term.

[Claim 15]The image formation approach which makes a thin layer claim 1 thru/or the electrophotography liquid development agent of 14 given in any 1 term on a roller or a belt, and is characterized by being established by ultraviolet rays after making it adhere to an electrostatic latent image, developing negatives and imprinting the formed image to a record medium.

[Claim 16]The image formation approach characterized by heating the transfer picture on a record medium in the image formation approach according to claim 15 before being established by ultraviolet rays.

[Claim 17]The image formation approach characterized by said ultraviolet rays being metal halide lamps with a wavelength of 200nm or more in the image formation approach according to claim 15 or 16.

[Claim 18]The image formation approach characterized by developing an electrostatic latent image after performing corona discharge to the thin layer (liquid toner layer) of the liquid development agent formed on the roller or the belt in the image formation approach of 17 claim 15 thru/or given in any 1 term.

[Claim 19]The image formation approach characterized by developing negatives in the image formation approach of 18 claim 15 thru/or given in any 1 term after making PURIUVETTO liquid adhere to an electrostatic latent image.

[Claim 20]The image formation approach characterized by imprinting a toner image on a middle imprint object after developing an electrostatic latent image, imprinting an image subsequently to an imprint member, and forming in the image formation approach of 19 claim 15 thru/or given in any 1 term.

[Claim 21]The image formation approach characterized by the contact angle theta of the photoconductor and the liquid development agent which form an electrostatic latent image being $\theta \geq 30$ degrees in the image formation approach of 20 claim 15 thru/or given in any 1 term.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the image formation approach using the liquid development agent and it which are used for electrophotography, electrostatic recording, or electrostatic printing.

[0002]

[Description of the Prior Art] Although the developer for electrophotography is divided roughly into a dry-developing agent and a liquid development agent, a liquid development agent has the profitableness by which a clear image is obtained from the toner particle size being small. Generally, a liquid development agent distributes binding resin, a coloring agent, and a charge control agent in the non-aqueous solvent of high resistance, and is manufactured by making a toner particle with a particle size of about 0.1-3.0 micrometers. In order not to use a heavy iron powder carrier like the process using a dry-developing agent in the approach of image formation, there are few loads to a machine and there is a merit which can respond to a high-speed print.

[0003] Although the various establishing methods, such as fixing by the hot platen, are learned from the rear face of fixing by the hot calender roll, fixing by the pressure, fixing by hot blast, fixing by flash plate light, and paper, as for fixing to imprint objects, such as paper, in the case of a liquid development agent, what combined fixing or these by the hot calender roll, hot blast, and the heat from the rear face of paper is common. This reason is that there are many systems to fix by using many aliphatic hydrocarbon of 200 degrees C or less of boiling points etc. as a solvent of a liquid development agent, and evaporating a solvent with heat.

[0004] However, the solvent steam was emitted into atmospheric air in this case at the time of fixing, and it was not desirable on the environment in many cases. For example, as a liquid development agent for hot calender roll fixing, there are a JP, 63-301966, A - No. 301969 official report, this 64 No. -50062-50067 official report, a 64-52167 official report, this 64 No. -142560-142561 official report, etc. Since the aliphatic hydrocarbon of a low-boiling point was the support liquid of a principal component, the gas of the aliphatic hydrocarbon had to be discharged out of the copying machine, or these had to supply the silicone oil for applying to a fixing roll, therefore the copying machine became complicated and they had problems, like article-of-consumption mark increase. Moreover, 130 or more iodination fats and oils were used for carrier liquid like JP, 8-272153, A, and although the approach which carries out an oxidation polymerization with air and is established was also learned, there were problems, like using the dryer containing metals, and stinking thing generating and fixing take time amount.

[0005] Moreover, although there was a merit which can carry out high-speed correspondence of the flash plate fixing in non-contact, there was a fault which cannot be established in a color toner with little light absorption. Although there was no problem in the environmental side by volatilization of gas when the carrier of a high-boiling point twisted to osmosis on paper, since it remained in the condition as it is in Kaminaka, there were problems, like the fixing force surely becomes weak.

[0006] For this reason, the approach established by the chemical reaction using UV etc. is proposed. However, when developing the electrostatic latent image on a photo conductor with a liquid toner by the xerography, there was a fault that a blot will occur if resistance of a liquid toner or its support liquid is low, or image dotage occurred.

[0007]

[Problem(s) to be Solved by the Invention] In view of the above-mentioned background, in the liquid development agent using chemical reactions, such as UV hardening, image concentration of this invention is high, and it aims at offering the image formation approach using the electrophotography liquid development agent and it which are stabilized and by which the image of high resolution is obtained.

[0008]

[Means for Solving the Problem] The purpose of above-mentioned this invention is attained by the following means. According to this invention, in the first place namely, in claim 1 In the electrophotography liquid development agent which contains support liquid and a coloring agent at least The monomer in which this

support liquid had the functionality partial saturation radical of the carbon of the liquid phase, or the polymer and photoreaction initiator of the liquid phase is included. As this photoreaction initiator This monomer or its polymer is received in this photoreaction initiator. 3wt(s)% -- the electrophotography liquid development agent characterized by containing the photoreaction initiator which is not reduced or less [of the monomer before this monomer at the time of making it contain or the volume resistivity of the polymer makes this photoreaction initiator contain, or the volume resistivity of the polymer] to 1/4 is offered.

[0009]In the electrophotography liquid development agent which contains [second] support liquid and a coloring agent at least by claim 2As polymerization inhibitor contained in this monomer or its polymer including the monomer in which this support liquid had the functionality partial saturation radical of the carbon of the liquid phase, or the polymer and photoreaction initiator of the liquid phaseThis monomer or its polymer is received in this polymerization inhibitor. 3wt(s)% -- the electrophotography liquid development agent characterized by containing the polymerization inhibitor which is not reduced or less [of the monomer before this monomer at the time of making it contain or the volume resistivity of the polymer makes this polymerization inhibitor contain, or the volume resistivity of the polymer] to 1/4 is offered.

[0010]third claim 3 -- the electrophotography liquid development agent of the claim 1 above-mentioned publication -- setting -- as a photoreaction initiator -- this photoreaction initiator -- 3wt(s)% -- the electrophotography liquid development agent characterized by containing the photoreaction initiator which is not reduced or less [of the monomer before the monomer at the time of making it contain or the volume resistivity of the polymer makes this photoreaction initiator contain, or the volume resistivity of the polymer] to 1/2 is offered.

[0011]fourth claim 4 -- the electrophotography liquid development agent of the claim 2 above-mentioned publication -- setting -- as polymerization inhibitor -- this polymerization inhibitor -- 3wt(s)% -- the electrophotography liquid development agent characterized by containing the polymerization inhibitor which is not reduced or less [of the monomer before the monomer at the time of making it contain or the volume resistivity of the polymer makes this polymerization inhibitor contain, or the volume resistivity of the polymer] to 1/2 is offered.

[0012]The electrophotography liquid development agent characterized by the volume resistivity of the monomer which had [fifth] the above-mentioned partial saturation radical by claim 5 in above-mentioned claim 1 thru/or the electrophotography liquid development agent of four given in any 1 term, or its polymer being 1010 or more ohm-cm is offered.

[0013]The electrophotography liquid development agent characterized by the monomer which had [sixth] the above-mentioned partial saturation radical by claim 6 in above-mentioned claim 1 thru/or the electrophotography liquid development agent of five given in any 1 term, or its polymer being polyfunctional is offered.

[0014]By claim 7, the electrophotography liquid development agent characterized by the above-mentioned polyfunctional monomer or its polymer being 15% or less of rates of a volumetric shrinkage is offered [seventh] in the electrophotography liquid development agent of the claim 6 above-mentioned publication.

[0015]By claim 8, the electrophotography liquid development agent characterized by P.I.I of the above-mentioned polyfunctional monomer or its polymer being 1.0 or less is offered [eighth] in above-mentioned claim 6 or an electrophotography liquid development agent given in seven.

[0016]By claim 9, the electrophotography liquid development agent characterized by the hue (Gardner) of the above-mentioned polyfunctional monomer or its polymer being two or less is offered [ninth] in above-mentioned claim 6 thru/or the electrophotography liquid development agent of eight given in any 1 term.

[0017]The electrophotography liquid development agent characterized by tenth including aromatic series or aliphatic series urethane acrylate by claim 10 in above-mentioned claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term in a part of above-mentioned polyfunctional monomer or its polymer [at least] is offered.

[0018]The electrophotography liquid development agent characterized by eleventh including epoxy acrylate by claim 11 in above-mentioned claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term in a part of said polyfunctional monomer or its polymer [at least] is offered.

[0019]The electrophotography liquid development agent characterized by twelfth including polyester acrylate by claim 12 in above-mentioned claim 6 thru/or the electrophotography liquid development agent of nine given in any 1 term in a part of said polyfunctional monomer or its polymer [at least] is offered.

[0020]By claim 13, the electrophotography liquid development agent characterized by viscosity being 100 thru/or 10000 mPa-s is offered [thirteenth] in above-mentioned claim 1 thru/or the electrophotography liquid development agent of 12 given in any 1 term.

[0021]The electrophotography developer characterized by 14th carrying out Flushing of the coloring agent by claim 14 in above-mentioned claim 1 thru/or the electrophotography liquid development agent of 13 given in any 1 term by 30 degrees C of softening temperatures and 120-degree C resin is offered.

[0022]After imprinting the image which made the thin layer above-mentioned claim 1 thru/or the electrophotography liquid development agent of 14 given in any 1 term on the roller or the belt, was made to adhere to an electrostatic latent image in claim 15, developed negatives, and was formed [15th] to a record medium, the image formation approach characterized by being established by ultraviolet rays is offered.

[0023]Before being established [16th] by ultraviolet rays in the image formation approach of the claim 15 above-mentioned publication by claim 16, the image formation approach characterized by heating the transfer picture on a record medium is offered.

[0024]By claim 17, the image formation approach characterized by said ultraviolet rays being metal halide lamps with a wavelength of 200nm or more is offered [17th] in the image formation approach above-mentioned claim 15 or given in 16.

[0025]After performing corona discharge to the thin layer of the liquid development agent formed [18th] on the roller or the belt by claim 18 in the image formation approach of 17 above-mentioned claim 15 thru/or given in any 1 term, the image formation approach characterized by developing an electrostatic latent image is offered.

[0026]After making PURIETTO liquid 19th adhere to an electrostatic latent image in claim 19 in the image formation approach of 18 above-mentioned claim 15 thru/or given in any 1 term, the image formation approach characterized by developing negatives is offered.

[0027]In claim 20, a toner image is imprinted on a middle imprint object after developing an electrostatic latent image in the image formation approach of 19 above-mentioned claim 15 thru/or given in any 1 term, and the image formation approach characterized by subsequently to an imprint member imprinting and forming an image is offered [20th].

[0028]The image formation approach characterized by the contact angle theta of the photoconductor and the liquid development agent which form [21st] an electrostatic latent image by claim 21 in the image formation approach of 20 above-mentioned claim 15 thru/or given in any 1 term being $\theta \geq 30$ degrees is offered.

[0029]

[Embodiment of the Invention]This invention is explained below at a detail. The

liquid development agent of this invention uses the monomer which had the functionality partial saturation radical of carbon as support liquid as mentioned above, or its polymer, makes an image form using what does not lower resistance to a photoreaction initiator and polymerization inhibitor greatly, and carries out chemistry fixing. When the monomer weight to dissolve makes a photoreaction initiator contain 3%, a volume resistivity uses what does not become 1/2 or less desirably 1/4 or less. When the monomer weight to dissolve also makes polymerization inhibitor contain 3%, that from which a volume resistivity does not become 1/2 or less desirably 1/4 or less is used. Since the case of polymerization inhibitor where it has already contained is common, it needs to choose such polymerization inhibitor from the phase of monomer manufacture, and needs to make a monomer from the monomer of a commercial item.

[0030]When a photoreaction initiator is made to contain 3%, there are a benzophenone, benzoin ethyl ether, benzoin iso-propyl ether, benzyl, the Ciba Specialty Chemicals IRUGA cure 1300, the IRUGA cure 369, the IRUGA cure 907, RUSHIRIN TPO by BASF A.G., etc. in the photoreaction initiator which does not reduce resistance of a monomer or less to 1/4. Especially benzoin iso-propyl ether or the Ciba Specialty Chemicals IRUGA cure series do not reduce resistance or less to 1/2, and are good. Conversely, IZAKIYUA KTO (product made from Siebel Systems Japan HEGUNA) and kaya KYUA DETX-S (Nippon Kayaku Co., Ltd. make) make resistance 1/4 or less, and are not suitable.

[0031]When polymerization inhibitor is made to contain 3%, there are 2, 6-JI tert-butyl-p-cresol (BHT), 2, 3-dimethyl-6-tert-butylphenol (IA), Anthraquinone, etc. in the polymerization inhibitor which does not reduce resistance of a monomer or less to 1/4. Especially 2 and 6-JI tert-butyl-p-cresol (BHT) does not make resistance 1/2 or less, and is good. Conversely, hydroquinone (HQ) and the hydroquinone monomethyl ether (MEHQ) make resistance 1/4 or less, and are not suitable.

[0032]As an example of a monomer, in a monofunctional thing 2-ethylhexyl acrylate, 2-hydroxyethyl acrylate, 2-hydroxypropyl acrylate, 2-hydroxyethyl bitter taste roil phosphate, In the thing of monomers, such as tetrahydrofurfuryl acrylate and in decyl acrylate, and the polymer of those, and two organic functions 1,3-butanediol diacrylate, 1,4-butanediol diacrylate, 1,6-hexanediol diacrylate, diethylene glycol diacrylate, Tripropylene glycol diacrylate, neopentyl glycol diacrylate, In the thing of monomers, such as zinc diacrylate and ethoxylation bisphenol A diacrylate, and the polymer of those, and three organic functions Monomers, such as trimethylolpropane triacrylate, PENTAERISUTORUTORI acrylate, and a tris (2-hydroxyethyl) isocyanurate thoria chestnut rate, and the polymer of those are mentioned. In the thing of four or more organic functions, monomers, such as pentaerythritol tetraacrylate, ditrimethylolpropanetetraacrylate, dipentaerythritol hydroxy pentaacrylate, and dipentaerythritol hexa acrylate, and the polymer of those are mentioned.

[0033]10¹² or more ohm-cm is desirably required for the volume resistivity of these monomers and its polymer 10¹⁰ or more ohm-cm. When resistance of a monomer is low, since formation of the image to a photo conductor top is confused, and an image may be unable to be formed, in an electrophotography liquid development agent, it is desirable for there to be as much as possible few impurities which lower resistance.

[0034]The monomer of many organic functions or its polymer has a cure rate quicker than a monofunctional monomer or its polymer, and it is suitable when it is high-speed fixing. Moreover, since contraction takes place by the hardening reaction, it is desirable to use a monomer with as much as possible few rates of a volumetric shrinkage and its polymer. In the case of the monomer greatly contracted by the hardening reaction, a record medium will be generated by curl at the times, such as a regular paper. Curl is suppressed even when a record medium will be a regular paper, if the thing of 15% or less of rates of a volumetric shrinkage is used.

[0035]As for the monomer to be used or P.I.I. (skin irritation) of the polymer,

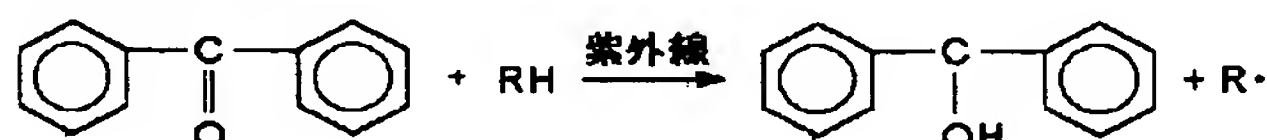
1.0 or less are desirable. P. With [I.I.] 5.0 [or more], the stimulus to the skin is too strong and a problem appears in safety. Moreover, a thing near as transparently and colorlessly as possible is desirable, and, as for the hue of said monomer or its polymer, two or less are desirable in the Gardner gray scale. The color of the image section will especially change that the Gardner gray scale is two or more, or discoloration of the natural complexion section will be conspicuous.

[0036] It is desirable to include the urethane acrylate of aromatic series or aliphatic series in a part of said monomer or its polymer. When urethane acrylate is contained, flexibility improves and the flexural strength of a fixing image rises.

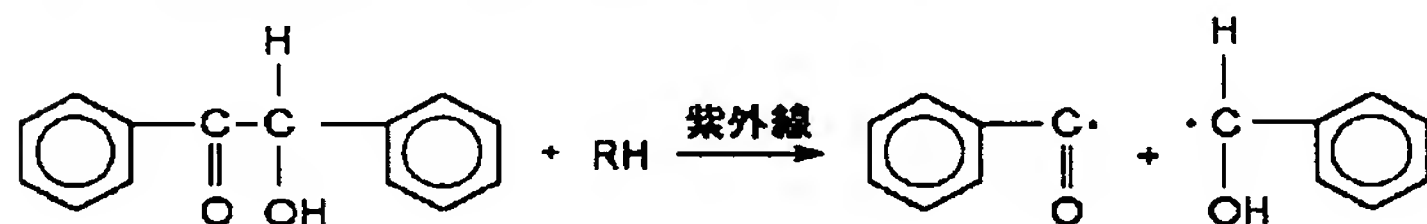
[0037] It is desirable to include epoxy acrylate or polyester acrylate in a part of said monomer or its polymer. When epoxy acrylate or polyester acrylate is contained, the hardness of a fixing image front face improves and scratch reinforcement rises.

[0038] When a radical is generated as the monomer or oligomer with the functionality partial saturation radical of carbon showed in (1) and (2) types under addition of a photopolymerization initiator, when ultraviolet rays were irradiated, and the radical repeats the addition reaction to a polymerization nature double bond, a polymerization reaction advances like (3) types.

[Formula 1]



(1) Hydrogen drawing die [** 2]



(2) Optical cleavage mold [** 3]



(3) Polymerization [0039] It is important for a photopolymerization initiator not to reduce liquid resistance as mentioned above, and the property of not causing ** dark reaction with low ** odor with the high solubility to ** monomer or oligomer with high absorption efficiency of **UV and toxicity is also required. The addition of a photopolymerization initiator is desirably [about 2 - 5% of] good about 1 to 10%.

[0040] Moreover, in the case of the benzophenone system photopolymerization initiator of a hydrogen drawing die, only by the photopolymerization initiator, since a reaction becomes slow, reactivity can be raised by using the sensitizer of an amine system together. By making the sensitizer of an amine system contain, hydrogen is supplied to a photopolymerization initiator according to ** hydrogen drawing operation. ** There is effectiveness of preventing the reaction inhibition by the oxygen in air.

[0041] The addition of an amine system sensitizer is desirably [3 - 8% of] good 1 to 15%. There is triethanolamine, tri-isopropanolamine, 4, and 4-diethylamino benzophenone, 2-dimethylaminoethyl benzoic-acid, 4-dimethylamino ethyl benzoate, and 4-dimethylamino benzoic-acid iso acyl etc. in an amine system sensitizer. Like [these sensitizers] a photoinitiator, when it adds 3%, it is desirable to use what does not reduce liquid resistance or less to 1/4.

[0042] As for the wavelength of the ultraviolet rays to be used, it is desirable that it is 200nm or more. If it is 200nm or more, there is no generating of ozone and it is desirable on an environment. In order to make it 200nm or more, it is

common to attach and cut a filter. Since the liquid development agent of this invention contains the coloring agent, especially its metal halide lamp that does not have nonuniformity in wavelength is good.

[0043]Furthermore, it is effective when a quick fixing rate is required, and heat fixing and ultraviolet-rays fixing are used together. It is better to incorporate heat fixing before ultraviolet-rays fixing, although heat fixing is [hot calender roll fixing, rear-face fixing, warm air fixing, etc.] effective of either.

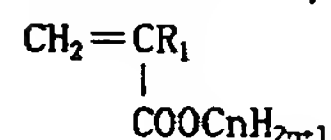
[0044]When using hot calender roll fixing together, and what mixed silicone oil of 210 degrees C or more of flash points is used for support liquid, there is no generating of offset. as silicone oil of 210 degrees C or more of flash points -- KF96 20-10000 -- cst (Shin-etsu silicon), SH344 (Toray Industries silicon), TSF451 series, TSF404 (annular dimethylpolysiloxane), TSF4704 (amino denaturation silicone) (Toshiba silicon), etc. are mentioned.

[0045]As for the viscosity of a liquid development agent, it is desirable that it is the range of 100 - 10000 mPa-s. When lower [than 100 mPa-s] and a record medium is paper, there is much penetration of liquid and the concentration of the natural complexion section will change. Moreover, if higher than 10000 mPa-s, development and spreading will be difficult and nonuniformity will occur.

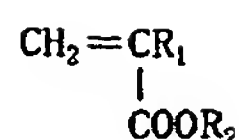
[0046]As a coloring matter which can be used for this invention, the pudding tex V, the pudding tex UThe pudding tex G, the special black 15, the special black 4, special black 4-B (above Degussa AG make), Mitsubishi #44, #30, MR-11, MA-100 (above Mitsubishi Kasei Corp. make), Rahaeng 1035, Rahaeng 1252, news PEKUTO II (above Colombia carbon company make), legal one -- inorganic pigments, such as 400, 660, black pearls 900, 1100, and 1300, and the mho gal L (above Cabot Corp. make), and a copper phthalocyanine blue --Phthalocyanine Green, sky blue, a rhodamine lake, the Malachite Green lake, Violet Lake, a peacock blue lake, naphthol Green BNaphthol Green Y, Naphthol Yellow S, naphthol red, RISORU first yellow 2G and Permanent Red 4R, brilliant fast scarlet, Hansa yellow, benzidine yellow, Lithol Red, Lake Red COrganic pigments, such as Lake Red D, brilliant carmine 6B, and Permanent Red F5R, pigment scarlet 3B indigo, thioindigo oil pink, and Bordeaux 10B, are mentioned.

[0047]Especially in these coloring agents, when Flushing processing is performed, the liquid development agent excellent in the image side is obtained. With the Flushing processing, a resin dispersion medium is further added to the water liquid which melted coloring matter in water, it mixes well in the kneader called a flasher, and the processing which permutes the water which exists in the surroundings of a pigment by the resin dispersion medium added later is said. Discharge the water taken out by this actuation, and consider as the condition that the pigment was distributed in the resin solution, it is made to dry, and the powder of a coloring agent is obtained by removing a solvent and grinding the obtained lump. The resin used by the Flushing processing has good resin of 30-120 degrees C of softening temperatures from the point of fixable and shelf life. As an example of resin of 30-120 degrees C of softening temperatures, Sun Wacks E200 (95 degrees C of softening temperatures), 131-P (108 degrees C of softening temperatures) (Mitsuhiro formation shrine make), AC polyethylene 1702 (85 degrees C of softening temperatures), AC polyethylene 430 (60 degrees C of softening temperatures) (ARAIDO chemical company make), BR-95 (80 degrees C of softening temperatures), BR-101 (50 degrees C of softening temperatures), etc. are mentioned.

[0048]Moreover, as resin for distribution with desirable using together to this invention, it is [Formula 4].



(-- R1 expresses the integer of ** 6-20 for H or CH3 among a formula.) -- the vinyl monomer expressed and [Formula 5]



(type Naka and R1 express H or CH₃, and R2 express H, CmH_{2n+1}[n=1-5] C₂H₄OH, or C₂H₄N (CmH_{2m+1}) [m=1-4]2. The vinyl monomer and vinylpyridine which are) and are expressed, Every one sort each or several sorts of copolymers or the graft copolymer of a monomer chosen from vinyl pyrrolidone, ethylene glycol dimethacrylate, styrene, a divinylbenzene, and vinyltoluene is mentioned.

[0049]These coloring matters, resin, and support liquid are thrown into dispersers, such as a ball mill, KITIMIRU, a disc mill, and a pin mill, distribution and kneading can be performed, a concentration toner can be prepared, and a developer can be obtained by distributing this in the support liquid of this invention.

[0050]Moreover, high concentration and the image of high resolving are obtained in making this liquid development agent into a thin layer, and developing it on a roller or a belt. About 1-15 micrometers of thickness are good, and its 3-10 micrometers are desirably good. 1 micrometer or less of thickness is not enough as concentration, and resolution falls in 15 micrometers or more. After performing corona discharge in the liquid toner layer for electrostatic-charge images formed on the roller or the belt further again, by developing an electrostatic latent image, KOFUYUJON of a toner can be raised and resolution can be raised further. In the case of a toner and like-pole nature, effectiveness of corona discharge is high, and, as for an electrical potential difference, about 500-8000V is good.

[0051]Hereafter, the image production process of the image formation method of this invention is explained. Drawing 1 is the photoconductor 101 (for example, an organic light semi-conductor, a selenium, amorphous silicone) which rotates in the direction of an arrow head, and it electrifies photoconductor with the corona-electrical-charging vessel 102, rotating this. 103 is a roller in the case of PURIETTO [carrier liquid]. 104 writes in and is the exposure section. 105 receives supply of a toner from a toner bottle 106 with a developing roller, and is applied to homogeneity with the toner roller 107. As for the toner layer on a developing roller 105, an electrical potential difference is impressed by the corona discharge section 113 if needed, and the latent image on photoconductor 101 is developed by the developing roller 105, and is visualized. The shape of a metal, rubber, plastics, and sponge and the thing of each roller which has slots, such as a wire bar and a gravure roller, further are also usable. The toner image on photoconductor 101 is imprinted on the imprint material 109 with the imprint roller 108. The approach of an imprint can form an image on imprint material with combination, such as a pressure, corona discharge, heating, heating, a pressure, a corona, a pressure and a corona, and heating. The cleaning roller 110 and cleaning blade 111 for cleaning a photoconductor 101 top remove a residual toner, and it prepares for the next imaging.

[0052]Drawing 2 includes the process which coats PURIETTO liquid with the felt 112 from a roller as a different point from drawing 1. PURIETTO liquid is applied with the felt 112 if needed. A toner is applied to a developing roller 105 through Rollers 115a and 115b from a toner bottle 106, and direct current voltage is impressed to the applied toner layer from the corona discharge section 113. The developing roller 105 of drawing 2 has made contact width of face with photoconductor 101 longer than drawing 1, and it has devised it so that a latent image can be developed enough. The toner image developed on photoconductor 101 is imprinted by the imprint material 109 by the corona discharge section 114, and an image is formed.

[0053]Drawing 3 shows an example of the development process in the case of outputting a color copy. Yellow, a Magenta, cyanogen, the toner bottle 106 of black, and the toner roller 107 are on photoconductor 101, the latent image of a photo conductor 101 is developed for every Isshiki, and it imprints with a

pressure, a corona, heat, etc. with the imprint roller 108 to the imprint material 109 further after imprinting on the middle imprint object 116.

[0054] Drawing 4 is an imaging process for color copies. The latent image on photoconductor 101 is developed like drawing 3 with the toner bottle 106 which holds yellow, a Magenta, cyanogen, and a black toner, and the belt 117 to which the toner layer was applied by the developing roller 105 through the toner roller 107, and a toner image is imprinted to the imprint member 109. A cleaning roller 118 and a cleaning blade are arranged at the belt 117 which applies a toner layer, and the belt cleaned by these is reused.

[0055]

[Example] Next, an example explains this invention to a detail further. However, this invention is not limited by the following examples. In addition, all the sections express the weight section among an example.

[0056]

(Example 1)

Sun Wacks 151P (shrine resin: Mitsuhiro formation softening temperature : 107 degrees C) The 70 sections Carbon black (Degussa AG Printex) The 2 roll during 30 minutes ground the 20 sections after kneading at 140 degrees C.

Said grinding object The 50 sections Octylic acid zirconium The five sections Trimethylol propane tetraacrylate (TMPTA) The 100 section Isobornyl methacrylate The 100 sections (polymerization inhibitor 2, 200 ppm (BHT) content of 6-JI tert-butyl-p-cresol)

IRUGAKYUA 369 (tiba chemical) (photoreaction initiator) The ten sections were put into the ball mill, it distributed for 24 hours, and the developer of an example 1 was produced. The volume resistivity before the volume resistivity/dissolution when dissolving BHT3% in TMPTA = it is 0.91 and resistance hardly fell. IRUGAKYUA 369 The volume resistivity before the volume resistivity/dissolution when dissolving 3% in TMPTA = it is 0.94 and resistance hardly fell. In addition, measurement of a volume resistivity read the current value from a recorder with the measuring instrument shown in drawing 5, and calculated it by the formula of volume-resistivity = $V/I \times S/L$. Among a formula, in V, a current value and S express the electrode surface product of a cel, and, as for L, applied voltage and I express the inter-electrode distance of a cel.

[0057] (Example 2) Except having made the photoreaction initiator of an example 1 into RUSHIRIN TPO (BASF) from IRUGAKYUA 369 (tiba chemical), it was made the same as that of an example 1, and the developer of an example 2 was produced. The volume resistivity before the volume resistivity/dissolution when dissolving RUSHIRIN TPO3% in TMPTA = it is 0.46 and the resistance after the initiator dissolution became 1/2 or less [before the dissolution].

[0058] (Example 1 of a comparison) Except having made the photoreaction initiator of an example 1 into kaya KYUA DETX-S (Nippon Kayaku Co., Ltd. make) from IRUGAKYUA 369 (tiba chemical), it was made the same as that of an example 1, and the developer of the example 1 of a comparison was produced. The volume resistivity before the volume resistivity/dissolution when dissolving kaya KYUA DETX-S3% in TMPTA = it is 0.03 and the resistance after the initiator dissolution fell sharply or less [before the dissolution] with 1/4.

[0059] (Example 2 of a comparison) Except having changed into MEHQ from BHT the polymerization inhibitor contained in TMPTA (to a monomer manufacture phase), it was made the same as that of an example 1, and the developer of the example 2 of a comparison was produced. The volume resistivity before the volume resistivity/dissolution when dissolving MEHQ3% in TMPTA = it is 0.15 and the resistance after the MEHQ dissolution became low or less [before the dissolution] with 1/4.

[0060] (Example 3 of a comparison) The polymerization inhibitor which makes the photoreaction initiator of an example 1 kaya KYUA DETX-S (Nippon Kayaku Co., Ltd. make) from IRUGAKYUA 369 (tiba chemical), and is contained in TMPTA was changed into HQ from BHT (from the monomer manufacture phase), except **, it was made the same as that of an example 1, and the developer of the example 3 of a comparison

was produced.

[0061] (Example 3)

BR-102 (resin by the Mitsubishi rayon company: softening temperature : 20 degrees C) The 75 sections Pigment Red57:1 (Fuji coloring matter company make) The 2 roll during 30 minutes ground the 20 sections after kneading at 80 degrees C.

Said grinding object The 50 sections Octylic acid zirconium The five sections PENTAERISUTORUTORI acrylate The 300 sections (polymerization inhibitor 2, 100 ppm (BHT) content of 6-JI tert-butyl-p-cresol)

IRUGAKYUA 819 (tiba chemical company make) The ten sections were put into the ball mill, it distributed for 24 hours, and the developer of an example 3 was produced.

[0062] (Example 4) Except having made the PENTAERISUTORUTORI acrylate of an example 3 into 2-hydroxypropyl acrylate, it was made the same and the developer of an example 4 was produced.

[0063] After the equipment of drawing 1 performed development and image ****, the UV irradiation of about 350nm high-pressure mercury lamp was performed by lamp output 120 W/cm and speed 10 m/min. Moreover, it examined also about the case where 100-degree C hot calender roll (oilless) fixing is performed before this UV irradiation. Moreover, the rate which can be independently hardened by 120 W/cm was also found. The result was as in degree table 1.

[0064]

[Table 1]

	液粘度 (mPa·s)	画像濃度	地肌濃度	解像力 (本/mm)	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	硬化速度 (m/min)
実施例 1	1500	1.43	0.04	6.3	99	100	30
実施例 2	1500	1.21	0.13	5.6	99	100	30
実施例 3	1300	1.30	0.06	6.3	99	100	50
実施例 4	230	1.23	0.10	3	97	99	25
比較例 1	1500	0.32	0.21	1	99	100	30
比較例 2	1500	0.26	0.18	1	99	100	30
比較例 3	1500	作像不可	-	-	99	100	30

* Measure image concentration and natural complexion concentration by X-Rite.

* The rate of fixing is based on a tape peel test.

* A transfer paper is T-6000 paper.

* A cure rate is the highest fixing rate which can attain 95% or more of rates of fixing by 120 W/cm.

[0065] Since examples 1 and 2 were using the ingredient which does not lower resistance to 1/4 or less for polymerization inhibitor and a photoreaction initiator, its development property was good and they were good. [of image quality, such as image concentration and a greasing,] Since the ingredient which does not make resistance 1/2 or less was being used especially for the example 1, it was especially good. Since 3 organic-functions monomer was being used for an example 3, the cure rate became quick rather than the example 4 of a monofunctional monomer.

[0066] (Examples 5 and 6) Except having changed dipropylene glycol diacrylate (example 5) and aliphatic series urethane acrylate (molecular weight 35000) (example 6) instead of the trimethylolpropane triacrylate of an example 1, it was made the same, the developer was produced and imaging and fixing were performed. As shown in Table 2, since the developer of an example 5 has viscosity lower than 100 mPa-s, there is much penetration to paper and natural complexion concentration becomes large. Since the developer of an example 6 had viscosity higher than 10000 mPa-s, development nonuniformity occurred and concentration fell.

[0067]

[Table 2]

	液粘度 (mPa·s)	画像濃度	地肌濃度	解像力 (本/mm)	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	硬化速度 (m/min)
実施例 1	1500	1.43	0.04	6.3	99	100	30
実施例 5	80	1.16	0.19	6.3	91	93	4
実施例 6	25000	0.69	0.05	6.3	94	96	8

- * Measure image concentration by X-Rite.
- * The rate of fixing is based on a tape peel test.
- * A transfer paper is T-6000 paper.

[0068] (Examples 7-9) PENTAERISUTORUTORI acrylate of an example 3 (11.7% of rates of a volumetric shrinkage)P. It is polyethylene-glycol diacrylate (8.7% of rates of a volumetric shrinkage) instead of I.I. 1.5 and the hue Gardner gray scale 1. P. I.I. 0.8, the hue Gardner gray scale 1 (example 7), Trimethylolpropane triacrylate (23.6% of rates of a volumetric shrinkage)P. I.I. Except having changed 4.0, the hue Gardner gray scale 1 (example 8), and epoxy soybean-oil acrylate (P. I.I. 0.8, hue Gardner gray scale 4) (example 9), it was made the same, the developer was produced and it evaluated similarly. Since the fixer of an example 7 is using the monomer with the small rate of a volumetric shrinkage as shown in Table 3, there is little curl. Since P.I.I. is using the large monomer, the fixer of an example 8 has the stimulus when adhering to a hand a little. Since oligomer with large Gardner was being used for the fixer of an example 9, natural complexion concentration became high.

[0069]

[Table 3]

	液粘度 (mPa·s)	画像濃度	地肌濃度	カール ランク	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	硬化速度 (m/min)
実施例 3	1300	1.30	0.06	3	99	100	50
実施例 7	1600	1.31	0.04	4	99	100	50
実施例 8	3500	1.21	0.09	2	99	100	50
実施例 9	8300	1.32	0.20	4	99	100	50

- * Measure image concentration and natural complexion concentration by X-Rite.

- * The rate of fixing is based on a tape peel test.
- * a curl rank is based on a phase sample (5: -- best and 1: -- the worst).
- * A transfer paper is T-6000 paper.

[0070] (Examples 10-14) The pentaerythritol thoria chestnut rate of an example 3 was made into the 150 sections, and it was established like the example 3 except having mixed the aromatic series urethane acrylate 150 section of molecular weight 40000. (Example 10) Mixing (example 11) and the polyester acrylate 150 section of molecular weight 52000 were similarly mixed for the bisphenol A epoxy acrylate 150 section of molecular weight 12000 (example 12), the developer was produced, and it evaluated similarly. As shown in Table 4, compared with the example 3, as for examples 10-12, the rate of curl became low. Moreover, elasticity came out, the example 10 had strong flexural strength and the examples 11-12 of scratch hardness improved. Curl will tend to become good if a with a molecular weight of 1000 or more mixed rate is made [many].

[0071]

[Table 4]

	液粘度 (mPa·s)	画像濃度	地肌濃度	カール ランク	曲げ強度/ 引っかかり 硬度	UV熱併用 定着率 (%)	硬化速度 (m/min)
実施例 3	1300	1.30	0.06	3	3/3	100	50
実施例 10	6800	1.30	0.05	5	5/4	100	50
実施例 11	3300	1.21	0.04	5	4/5	100	50
実施例 12	7600	1.25	0.05	5	4/5	100	50

- * Measure image concentration by X-Rite.
- * flexural strength -- it scratches and reinforcement is based on a phase sample.
- * The rate of fixing is based on a tape peel test.
- * A curl rank is based on a phase sample.
- * A transfer paper is T-6000 paper [0072]. (Example 13) The metal halide lamp was

used instead of the high-pressure mercury lamp, the filter was attached in UV equipment, and it was established like the example 1 except having cut the wavelength of less than 200nm. Consequently, the cure rate could be sped up from 30 m/min to 40 m/min, and there was no generating of ozone. The example 1 was 0.2 ppm of ozone generating.

[0073] (Example 14) Pigment Blue After kneading the 15:3 (product made from formation of great Nissei) 15 section, and the Sun Wacks E300 (shrine resin: Mitsuhiro formation softening temperature : 98 degrees C) 90 section with the kneader at 120 degrees C and kneading with a kneader, when tested like the example 1, image concentration improved with 1.53 except having Flushing-processed and having ground with the flasher.

[0074] (Example 15) When post-development which applied 3000V corona discharge to the toner layer using the equipment of drawing 2 was performed using the developer of an example 1, as shown in the following table 5, resolution improved.

[0075]

[Table 5]

	画像濃度	解像力 (本/mm)	シャープ ネス	ベタ 均一性	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	転写率 (%)	オフセット (併用の場合)
実施例 1	1.43	6.3	ランク 4	ランク 4	99	100	95	ランク 4.5
実施例 15	1.56	8.0	ランク 5	ランク 4	99	100	96	ランク 4.5

[0076] (Example 16) Using the developer of an example 1, the equipment of drawing 2 is used and it is a latent image on photoconductor by the PURIETTO roller F Silicone oil KF-96 When PURIETTO (0.5 micrometers of thickness) was carried out by 300cst and image **** was performed, as shown in the following table 6, image concentration and the rate of an imprint improved.

[0077]

[Table 6]

	画像濃度	解像力 (本/mm)	シャープ ネス	ベタ 均一性	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	転写率 (%)	オフセット (併用の場合)
実施例 16	1.62	7.1	ランク 4	ランク 5	99	100	98	ランク 5

[0078] (Example 17) Using the developer of an example 1, when image **** was performed using the middle imprint drum M of drawing 3 (polyurethane rubber, surface fluoridization), as shown in the following table 7, image concentration and the rate of an imprint improved.

[0079]

[Table 7]

	画像濃度	解像力 (本/mm)	シャープ ネス	ベタ 均一性	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	転写率 (%)	オフセット (併用の場合)
実施例 17	1.60	7.1	ランク 5	ランク 5	99	100	98	ランク 5

[0080] (Example 18) When oil-repellent processing (3 micrometers of thickness) was carried out to the photoconductor of the equipment of drawing 4 with a fluorine and the acrylic block copolymer resin (Nippon Oil & Fats MODIPA F210) and image **** was performed using the developer of an example 1, as shown in the following table 8, image concentration and the rate of an imprint improved. The contact angle of photoconductor and a developer was 45 degrees. The automatic contact angle meter CA-W mold (Consonance Interface Science) performed measurement of a contact angle.

[0081]

[Table 8]

	画像濃度	解像力 (本/mm)	シャープ ネス	ベタ 均一性	UVのみ 定着率 (%)	UV熱併用 定着率 (%)	転写率 (%)	オフセット (併用の場合)
実施例 18	1.60	7.1	ランク 5	ランク 5	99	100	99	ランク 5

[0082]

[Effect of the Invention]As mentioned above, according to the electrophotography liquid development agent of claim 1, the monomer which had the functionality partial saturation radical of carbon as support liquid, or its polymer is used, since an image is made to form using what does not lower liquid resistance to a photoreaction initiator greatly, image concentration is high and the electrophotography liquid development agent which was excellent in resolution can be obtained.

[0083]According to the electrophotography liquid development agent of claim 2, since the monomer which had the functionality partial saturation radical of carbon as support liquid, or its polymer is used and what does not lower liquid resistance to polymerization inhibitor greatly is used, as well as the above, image concentration is high and the electrophotography liquid development agent which was excellent in resolution can be obtained.

[0084]According to the electrophotography liquid development agent of claim 3, since what does not lower liquid resistance further rather than the photoreaction initiator in the liquid development agent of claim 1 is used, the electrophotography liquid development agent which excels the liquid development agent of claim 1 in image quality and shelf life further can be obtained.

[0085]According to the electrophotography liquid development agent of claim 4, since what does not lower liquid resistance further rather than the polymerization inhibitor in the liquid development agent of claim 2 is used, the electrophotography liquid development agent which excels the liquid development agent of claim 2 in image quality and shelf life further can be obtained.

[0086]According to the electrophotography liquid development agent of claim 5, since the volume resistivity of the monomer which has the above-mentioned partial saturation radical, or its polymer is 10¹⁰ or more ohm-cm, there is no fear of formation of the image to a photo conductor top when a volume resistivity is low becoming impossible as for turbulence and imaging.

[0087]According to the electrophotography liquid development agent of claim 6, since the monomer which has the above-mentioned partial saturation radical, or its polymer is polyfunctional, a cure rate is quick and the liquid development agent suitable for high-speed fixing can be obtained.

[0088]According to the electrophotography liquid development agent of claim 7, since the above-mentioned polyfunctional monomer or its polymer is 15% or less of rates of a volumetric shrinkage, the rate of curl of a record medium is low after fixing, and even when a record medium is a regular paper, the liquid development agent which can suppress generating of curl can be obtained.

[0089]According to the electrophotography liquid development agent of claim 8, since P.I.I (skin irritation) of the above-mentioned polyfunctional monomer or its polymer is 1.0 or less, a liquid development agent with high safety can be obtained.

[0090]According to the electrophotography liquid development agent of claim 9, since the hue (Gardner) of the above-mentioned polyfunctional monomer or its polymer is two or less, there is little color change of natural complexion and color reproduction nature can obtain a good liquid development agent.

[0091]According to the electrophotography liquid development agent of claim 10, since aromatic series or aliphatic series urethane acrylate is included in a part of above-mentioned polyfunctional monomer or its polymer [at least], the liquid development agent excellent in curl nature or flexural strength can be obtained.

[0092]According to the electrophotography liquid development agent of claim 11, since epoxy acrylate is included in a part of above-mentioned polyfunctional monomer or its polymer [at least], curl nature and the liquid development agent in which scratched and reinforcement was excellent can be obtained.

[0093]According to the electrophotography liquid development agent of claim 12,

since polyester acrylate is included in a part of above-mentioned polyfunctional monomer or its polymer [at least], curl nature and the liquid development agent in which scratched and reinforcement was excellent can be obtained.

[0094]According to the electrophotography liquid development agent of claim 13, since viscosity is 100 thru/or 10000 mPa-s, there is little penetration to a record medium and it can obtain a liquid development agent with little color change of the natural complexion section.

[0095]According to the electrophotography liquid development agent of claim 14, since Flushing of the coloring agent is carried out by resin of 30 degrees C - 120 degrees C of softening temperatures, it can obtain image concentration and the liquid development agent which is excellent in fixable.

[0096]Since according to the image formation approach of claim 15 a liquid development agent is made into a thin layer, an electrostatic latent image is developed and it is established by ultraviolet rays, fixable is good and a good image is obtained.

[0097]Since according to the image formation approach of claim 16 a liquid development agent is made into a thin layer, an electrostatic latent image is developed and it is established by heat and ultraviolet rays, from the case of above-mentioned claim 15, fixable is still better and a good image is obtained.

[0098]According to the image formation approach of claim 17, in the above-mentioned image formation approach, in order to use a metal halide lamp with a wavelength of 200nm or more as ultraviolet rays, there is no generating of ozone with fixable [of a dark color / sufficient].

[0099]According to the image formation approach of claim 18, since an electrostatic latent image is developed after performing corona discharge to the thin layer of a liquid development agent, resolution and sharpness improve.

[0100]According to the image formation approach of claim 19, since negatives are developed after making PURIETTO liquid adhere to the electrostatic latent-image section, imprint nature and image concentration improve.

[0101]According to the image formation approach of claim 20, since a toner image is imprinted on a middle imprint object after developing an electrostatic latent image and an image is made to form subsequently to an imprint member, imprint nature and image concentration improve.

[0102]According to the image formation approach of claim 21, since the contact angle theta of the photoconductor which forms an electrostatic latent image, and the liquid development agent used in development is $\theta \geq 30$ degrees, imprint nature and image concentration improve.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The block diagram of an outline showing an example of the imaging process by liquid development.

[Drawing 2]The block diagram of an outline showing another example of the imaging process by liquid development.

[Drawing 3]The block diagram of an outline showing an example of the imaging process in the case of outputting a color copy.

[Drawing 4]The block diagram of an outline showing another example of the imaging process in the case of outputting a color copy.

[Drawing 5]The explanatory view of the outline of the measuring instrument of the volume resistivity used in the example and the example of a comparison.

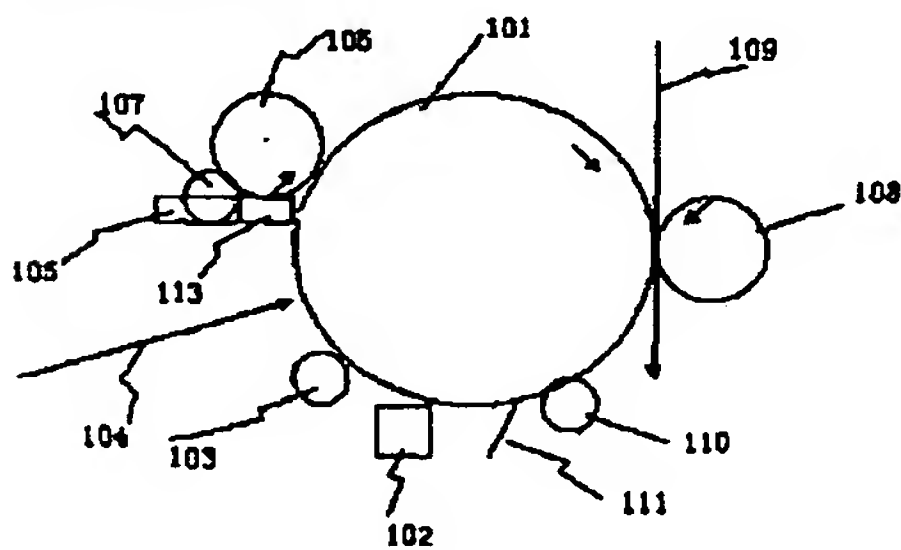
[Description of Notations]

101 Photoconductor

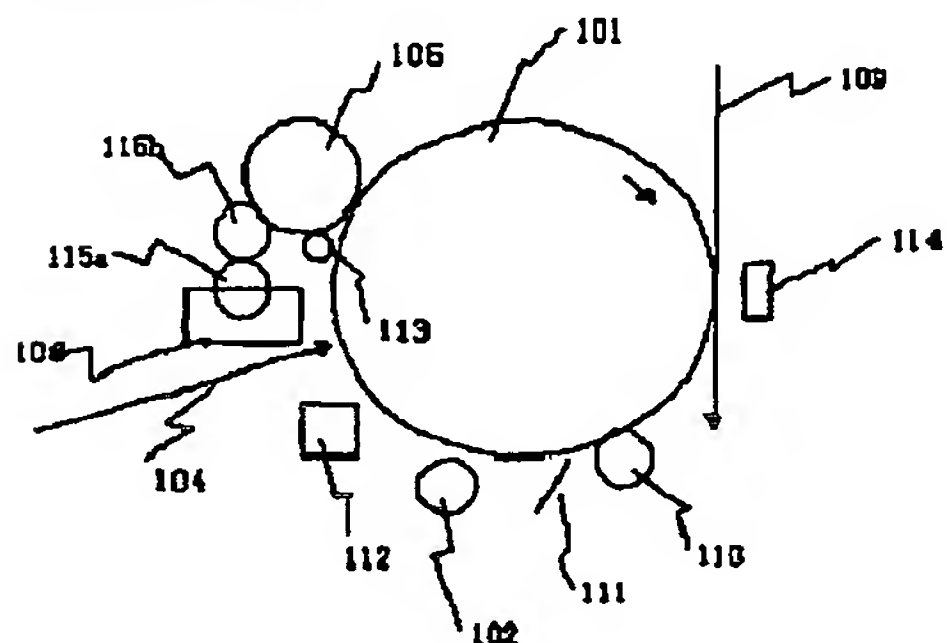
- 102 Corona-Electrical-Charging Machine
- 103 Roller in Case of PURIQUETTO [Carrier Liquid]
- 104 Write-in Exposure Section
- 105 Developing Roller
- 106 Toner Bottle
- 107 Toner Roller
- 108 Imprint Roller
- 109 Imprint Material
- 110 Cleaning Roller
- 111 Cleaning Blade
- 112 Felt
- 113 Corona Discharge Section
- 114 Corona Discharge Section
- 115a, 115b Roller
- 116 Middle Imprint Object
- 117 Belt
- 118 Cleaning Roller O

DRAWINGS

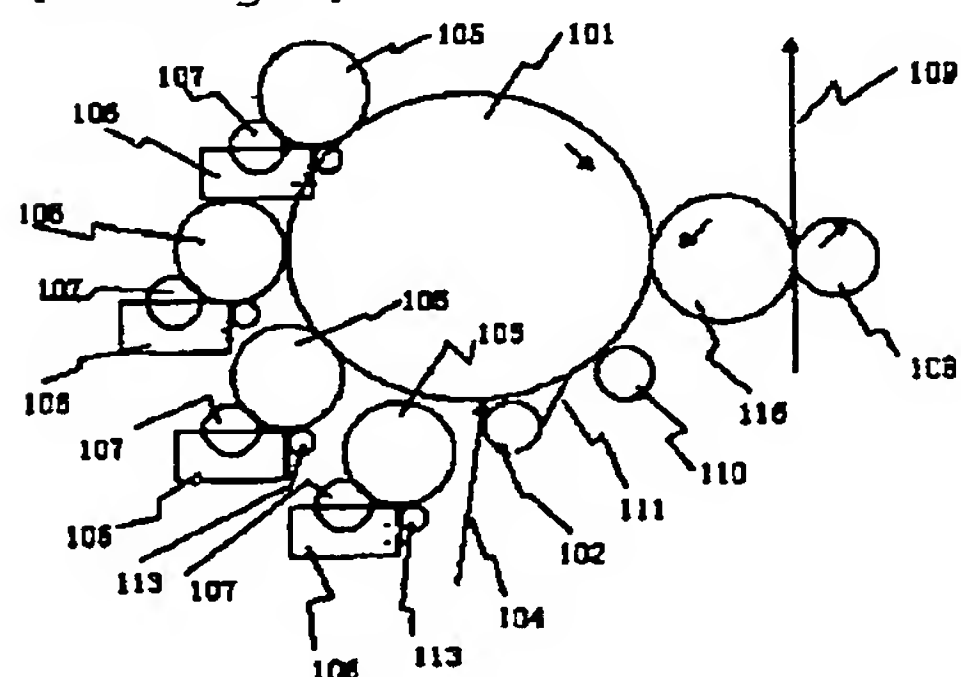
[Drawing 1]



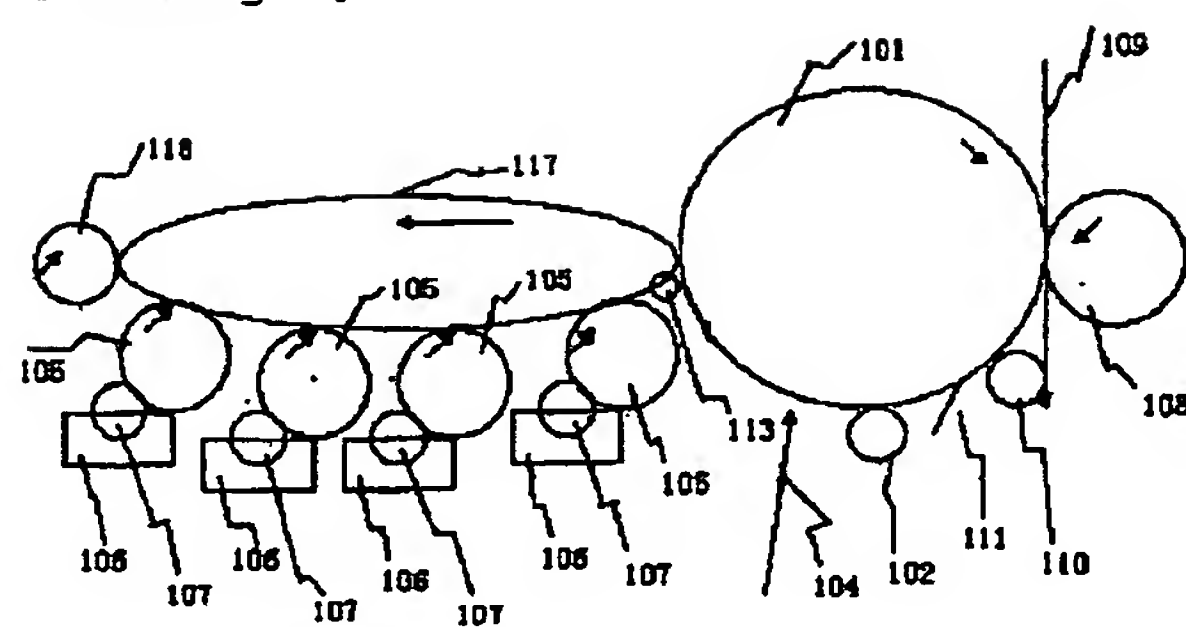
[Drawing 2]



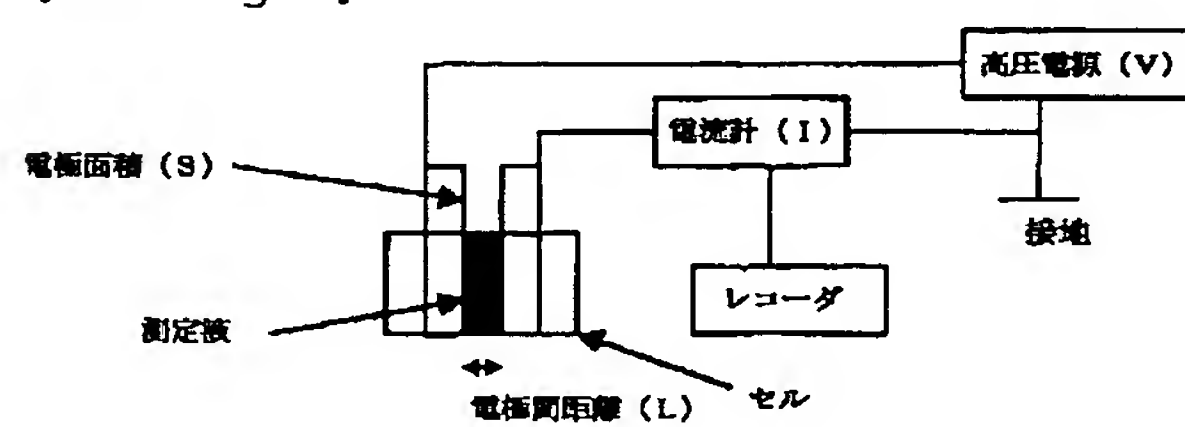
[Drawing 3]



[Drawing 4]



[Drawing 5]



(19)



JAPANESE PATENT OFFICE

PATENT ABSTRACTS OF JAPAN

(11) Publication number: **2003057883 A**

(43) Date of publication of application: **28.02.03**

(51) Int. Cl
G03G 9/12
G03G 9/13
G03G 15/10
G03G 15/20

(21) Application number: **2001241356**

(22) Date of filing: **08.08.01**

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**(54) ELECTROPHOTOGRAPHIC LIQUID DEVELOPER
AND METHOD FOR FORMING IMAGE**

(57) Abstract:

PROBLEM TO BE SOLVED: To provide an electrophotographic liquid developer so as to obtain stable images with high image density and high resolution in a liquid developer which uses chemical reaction such as UV curing and to provide a method for forming an image by using the developer.

SOLUTION: In the electrophotographic liquid developer

containing at least a carrier liquid and a coloring agent, the carrier liquid contains a monomer in a liquid phase having a functional unsaturated group between carbon atoms or a polymer in a liquid phase of the monomer, and a photoreaction initiator. A material which does not decrease the volume resistance of the monomers or the polymer is used for the photoreaction initiator or a polymerization inhibitor included in the monomer or the polymer.

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